EPA Contract Number
68-W98-085

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92U-7200-001

Chemical Ranking Report for the RCRA PBT List Docket

Final Report

September 30, 1998

Prepared for

Office of Solid Waste
U.S. Environmental Protection Agency
401 M Street, SW (5302W)
Washington, DC 20460

Prepared by

Center for Environmental Analysis
Research Triangle Institute
Research Triangle Park, NC 27709

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1.0 Introduction

EPA's Office of Solid Waste is developing the RCRA Waste Minimization List of Persistent, Bioaccumulative, and Toxic (PBT) chemicals (hereinafter referred to as the "RCRA PBT List") that will be used to identify and focus waste minimization program initiatives. The RCRA PBT List will also be used to track progress towards the goals of the *Waste Minimization National Plan* (*WMNP*) (EPA, 1994) and the *Government Performance and Results Act* (GPRA) of 1993 (U.S. Congress, 1993). As part of this effort, RTI assisted the Agency in the development of a methodology to rank chemicals for selection on the RCRA PBT List. The ranking methodology combines risk-related criteria with programmatic criteria to generate an overall ranking of chemicals. One of the primary data sources considered in the development of this methodology is the September 1998 revised Waste Minimization Prioritization Tool (USEPA, 1998a, 1997b) (*WMPT*). The WMPT is a tool that prioritizes chemicals based on persistence (P), bioaccumulation potential (B), and toxicity (T). The September 1998 revised WMPT data provide full or partial information for 4157 chemicals and allow generation of human or ecological PBT concern scores for 2895 chemicals. The ranking methodology considers the WMPT information along with other chemical-specific information such as, the amount of chemical generated as RCRA waste, to develop total chemical-specific scores for prioritizing the compounds of concern. The developed methodology was applied to chemicals identified on the candidate chemical list which is presented in the *Chemical Screening Report for the RCRA PBT List Docket* (RTI, 1998a). The candidate chemical list is comprised of 156 chemicals that have been identified as persistent, bioaccumlative, toxic, and present in hazardous waste. The purpose of this report is to present the ranking methodology and the resulting ranked list of chemicals.

2.0 Background

In November of 1994, EPA published the WMNP. The *WMNP* is based on the premise that pollution prevention efforts should be based on risk concerns, that there should be flexibility in the implementation of pollution prevention activities, and that pollutant reductions should be on a multi-media basis with no transfers of pollutants across media.

In 1993, Congress passed the GPRA to improve planning and accountability in the government by requiring federal departments and agencies to define their goals and objectives, and to track progress towards them. The *WMNP* has provided the framework for strategic planning in the Waste Minimization Branch within EPA's Office of Solid Waste and for the development of performance goals and measures for the Branch pursuant to the *GPRA*.

The *WMNP* established three national goals for minimization of "constituents in hazardous waste, or the compounds they degrade to, that pose potential threats to human health and the environment" because they are persistent, bioaccumulative, and toxic (PBT):

- To reduce the most PBT chemicals in hazardous waste streams by 50% by 2005, using 1991 as a baseline.
- To avoid transferring these constituents across environmental media.
- To ensure that these constituents are reduced at their source, whenever possible, or, when not possible, that they are recycled in an environmentally sound manner.

EPA is developing the RCRA PBT List of chemicals which will be used to identify and focus waste minimization program initiatives and to track progress towards the *WMNP* goals. The selection of chemicals for the RCRA PBT List needs to be a structured and objective approach to assessing each chemical. This report describes the method and the results of its application to the screened candidate chemical list.

3.0 Overview of Methodology

The ranking methodology combines risk-related criteria with programmatic criteria to generate an overall ranking of chemicals. Risk-related criteria are important because EPA is trying to move beyond using chemical quantity as the sole basis for assessing concern. The PBT constituent focus of the *WMNP* and GPRA waste minimization goals derives from a recognition that, in addition to mass, PBT considerations are key to evaluating the risk potential associated with a chemical. To complement the PBT information from the WMPT in determining risk potential, the ranking methodology also considers additional factors such as whether the chemicals have been detected in the environment. Programmatic factors are also considered because the purpose of the chemical list is to provide a basis for developing EPA RCRA program efforts and supporting state efforts in encouraging the minimization of PBT chemicals in waste. As seen from Table 1, four primary criteria have been identified for use in evaluating the chemicals of concern. The following identifies these criteria and the reasons that they are considered as part of the ranking methodology.

PBT Characteristics - The *WMNP* goals are based on reducing the most PBT chemicals. This criterion provides a means for identifying such compounds.

Environmental Presence - Under this criterion, national environmental databases are used to identify chemicals that are of concern because of their presence in the environment. If a chemical is identified as being present in the environment, particularly if it is found in the environment at a level of concern, then efforts should be made to reduce or eliminate future releases.

Quantity / Prevalence - This criterion serves as an indicator of how widely the chemical is used and generated in terms of waste quantity and industrial prevalence (i.e., the

Table 1. Overview of Ranking Methodology

Primary Criteria	Description	Subcriteria	Data Sources	Scoring	Comments
PBT Characteristics	The relative persistence, bioaccumulation and ecological and human toxicity characteristics of the chemical.	• Highest subscore (Eco or human health) from WMPT	• WMPT	Scoring system based on the higher of the two WMPT subscores for human concern or ecological concern (P + B + Human T or P + B + Eco T). Human concern and ecological concern subscores each range from 3 to 9 points in the WMPT. Most candidate chemicals score between 7 and 9 points, with a few candidates selected from existing Agency priorities scoring below 7 points or are not scored in the WMPT. Proposed scoring system: Higher WMPT subscore < 7 = score of 0. Higher WMPT subscore of 7 = score of 1. Higher WMPT subscore of 8 = score of 2. Higher WMPT subscore of 9 = score of 3.	A small number of candidate chemicals are not included in the WMPT system. This criterion was eliminated for those chemicals, and the score was based on the remaining three primary criteria, with weights adjusted accordingly.
Environmental Presence	Information about the frequency and quantity of chemical presence in the environment, as an indication of potential exposure and risk.	• Environmental databases (See data sources)	• EPA Fish Consumption Advisory Database	Scoring of the Fish Consumption Advisory Database was based on the number of advisories associated with each chemical. A review of the data indicated that a zero to 3 scale would be appropriate and could be applied as follows. No advisories = score of 0. 1 to 9 advisories = score of 1. 10 to 99 advisories = score of 2. greater 99 advisories = score of 3.	Each of the data sources represents a sub-criterion. Scoring of this criterion was based on chemical-specific analysis of each database. Each database was weighted equally in developing the total criterion score.
			• EPA National Sediment Inventory	Scores were developed based on the combined number of Tier 1 and Tier 2 Sampling Station Classifications associated with a given chemical. Sampling Stations classifications are defined as follows. Tier 1 - associated adverse effects are probable. Tier 2 - associated adverse effects are possible but expected infrequently. Tier 3 - no indication of associated adverse effects. A 0 to 3 scale was applied. The range of values associated with each discrete score, which were determined based on judgement, were as follows: Chemical not on list = score of 0 1 - 99 detections = score of 1 100 - 999 detections = score of 2 >999 detections = score of 3 (Note: This data source represents an evaluation of the National Sediment Inventory data. The NSI includes data from a number of data sources including the EPA's Storage and Retrieval System (STORET) and Ocean Data Evaluation System (ODES)).	

Table 1. (continued)

Primary Criteria	Description	Subcriteria	Data Sources	Scoring	Comments
			• ATSDR Hazdat (Superfund Sites)	Scoring of this data source considered the total number of current superfund sites associated with a given chemical. A 0 to 3 scale was developed based on the distribution of the number of sites associated with the compounds on the candidate chemical list. Scoring was as follows: chemical not in database = 0 1-99 current sites = 1 100-499 current sites = 2 >499 current sites = 3	
Quantity / Prevalence	How widely the chemical is present in waste, in terms of chemical quantity, waste stream quantity, and number of facilities generating or managing the chemical in waste.	• Quantity - estimated chemical quantity in waste (TRI or NHWCS)	TRI (primary) NHWCS (secondary)	Scores for this factor were developed based on the estimated quantity of chemical generated as hazardous wastes. For those chemicals reported in the Toxics Release Inventory (TRI), the score for this subcriterion was based on the total quantity of chemical in production-related waste, excluding direct releases to air and water. For those chemicals not reported in TRI, data from the National Hazardous Waste Constituent Survey (NHWCS) was applied in scoring this subcriterion. Two separate scoring systems were developed, one for TRI constituents and one for NHWCS constituents. A 0 to 3 scale was implemented as part of each system. Ranges of waste quantities were assigned to each discrete score. These ranges were determined based on analysis of the distributions of quantity data from each data source. Appendix A identifies the ranges associated with each discrete score. TRI Scoring: <1 lb = score of 0 1 - 1,000,000 lbs = score of 1 1,000,000 - 10,000,000 lbs = score of 2 >10,000,000 lbs= score of 3 NHWCS Scoring: <1 lb = score of 0 1 - 100,000 lbs= score of 1 100,000 - 1,000,000lbs = score of 2 >1,000,000 lbs = score of 3	The 2 subcriteria, Quantity and Prevalence, were considered in developing the total score for this criterion. Each subcriteria were weighted equally. The scores for the subcriteria were developed based on 2 factors, one based on TRI/NHWCS data and the other based on BRS data. The TRI/NHWCS and the BRS scores were weighted equally and summed to develop estimates for each subcriteria. Note that for any candidate chemicals which are not included in the RCRA crosswalk, scoring for BRS factors was not possible. For these chemicals, the total subcriteria scores were developed based on the TRI/NHWCS data only, with weights adjusted accordingly.

Table 1. (continued)

Primary Criteria	Description	Subcriteria	Data Sources	Scoring	Comments
		• Quantity - estimated quantity of waste associated with each chemical	BRS / chemical - RCRA waste code crosswalk	Scores for this factor were developed based on the estimated quantity of waste associated with a given compound. These estimates were obtained through the use of Biennial Reporting System (BRS) data and the chemical-RCRA waste code crosswalk. A 0 to 3 scale was applied for this scoring factor. Ranges of waste quantities were assigned to each discrete score. These ranges were determined based on analysis of the BRS quantity data distribution. <1 tons = score of 0 1 - 10,000,000 tons = score of 1 10,000,000 - 100,000,000 tons = score of 2 >100,000,000 tons = score of 3	
		• Prevalence - number of generators (TRI) or TSDFs managing waste (NHWCS)	TRI Reporting Forms R and A (primary source) NHWCS (secondary)	For those chemicals reported in TRI, the score for this subcriterion were based on the number of facilities filing a Form R or Form A for that chemical. For chemicals not reported in TRI, the number of hazardous waste treatment, storage, and disposal facilities (referred to as waste handlers) managing the wastes associated with a given chemical were estimated from the NHWCS. The scoring system applied for this subcriterion includes a 0 to 3 scale. TRI Scoring: 0 generators = score of 0 1-9 generators= score of 1 10 - 99 generators = score of 2 > 99 generators = score of 3 NHWCS Scoring: 0 handlers = score of 0 1-4 handlers = score of 1 5-10 handlers = score of 2 >10 handlers = score of 3	
		• Prevalence - number of reported generators of the chemical	BRS / chemical - RCRA waste code crosswalk	Scores for this factor were developed based on the number of facilities reporting a RCRA waste associated with a given compound. These estimates were obtained through the use of Biennial Reporting System (BRS) data and the chemical-RCRA waste code crosswalk. A 0 to 3 scale was applied for this scoring factor. 0 generators = score of 0 1-999 = score of 1 1000 - 9,999 = score of 2 >9,999 = score of 3	

Table 1. (continued)

Primary Criteria	Description	Subcriteria	Data Sources	Scoring	Comments
RCRA Programmatic Concerns	Identifies chemicals that are of concern in the RCRA program.	RCRA programmatic concerns	• Toxicity Characteristic (TC) List (40CFR261.24) • Appendix VII to 40CFR261 • Universal Treatment Standards (LDR UTS 40CFR268.48) • RCRA P list, U list, Appendix VIII, or Appendix IX • DNAPL chemicals • "Hard to treat" chemicals • MACT Combustion Proposed Rule compounds of concern (which includes the BIF metals)	Scores for this subcriterion were developed based on whether a constituent is present on a specific list or can be classified as a DNAPL chemical (dense non-aqueous phase liquids, which pose a heightened threat to groundwater because they are very difficult to remediate), a "hard to treat" chemical (chemicals of particular concern for the Land Disposal Restrictions program) , or a MACT Combustion Proposed Rule compounds (including the BIF rule metals). Scoring of this subcriterion was as follows: Presence on no lists of concern = score of 0. Presence on RCRA P list, U list, Appendix VIII, or Appendix IX = score of 1. Presence on UTS list = score of 2. Presence on TC/Appendix VII lists = score of 3. Classification of chemical as DNAPL related, "Hard to Treat", or MACT constituent of concern = score of 4.	

number of generators or the number of storage, treatment, and disposal facilities managing compound containing wastes). Assuming that quantity and prevalence are indicators of exposure potential, those chemicals associated with the greatest quantity and greatest number of generators would receive the highest scores under this criterion.

RCRA Programmatic Concerns - The *WMNP* goals are based on reducing the most PBT chemicals in hazardous wastes. Therefore, the RCRA PBT List should address chemicals that are of concern to the RCRA program and the regulated community.

In developing the ranking methodology, several other primary criteria were consider but were not included as part of the chemical scoring. These criteria are identified and discussed below. Even though these criteria were not considered in the chemical scoring, a few (e.g., *Significance to Other EPA Offices, Regions, and States* and *Waste Minimization Potential*) may be considered by the Agency in making the final selection of chemicals for the RCRA PBT List.

Waste Minimization Potential - This criterion was intended for use in evaluating the availability of waste minimization options for reducing the amount of chemical generated. This subcriterion was not included because the data needed to evaluate it may not be available for many of the constituents on the screened Candidate Chemical List. Also, it was viewed that inclusion of this criterion as part of the chemical scoring approach may serve as a disincentive for the development of new source reduction methods.

Other Environmental Effects of Chemicals, (e.g., global warming, ozone depletion, etc.) - This criterion was not included because many of the chemicals contributing to these types of effects would not be considered highly PBT. Therefore, to maintain the focus of this effort on the PBT properties of chemicals, this criterion was not included.

Appropriateness for a National Waste Minimization Program - This criterion was aimed at characterizing the significance of the chemicals on a national basis. However, it was decided that scoring of a chemical should be focused on those criterion that highlighted a chemical's potential to pose a threat to human health and the environment regardless of the geographic scope of concern. Therefore, it was decided that this criterion would be excluded. This criterion could be considered as part of the Agency's final review step to ensure that, other things being equal, the chemicals selected for the RCRA PBT List are significant to the nation as a whole and not just select regions or states. For example, as an indicator of the significance of the chemical on a national level the number of States containing generators of the chemical could be considered. The primary data sources that could be used in developing these estimates are the Toxics Release Inventory (TRI), National Hazardous Waste Constituent Survey (NHWCS), and the Biennial Reporting System (BRS).

Exposure Considerations - This criterion was originally considered but was replaced with the primary criterion Environmental Presence. The Exposure Consideration criterion was intended to provide a means for predicting if a compound is likely to partition to the medium of concern based on its chemical and physical properties. However, it was determined that the physical/chemical properties are inherent in PBT scoring and that this

criterion would be duplicating similar efforts considered in developing the WMPT PBT scores. Therefore, this criterion was replaced with the Environmental Presence criterion . This substitution represents a shift of focus from a predictive approach (i.e., predict environmental partitioning) to focusing on actual environmental conditions. Under this criterion, chemicals that have been detected in the environment at levels of concern receive the higher scores.

Significance to Other Programs, Regions, and States - Many of the EPA Offices and Regions maintain formal lists of constituents of concern. The presence of a chemical on one of these lists can be a likely indicator of actual environmental concern. However, only a limited number of these lists are intended to identify PBT chemicals. For this reason, scoring based on all of the identified lists of concern would not necessarily provide information relevant to achieving the *WMNP* and *GPRA* goals. As an alternative, scoring based on the PBT lists of concern was considered. However, it appeared that considering the PBT lists would duplicate scoring under the PBT Characteristic criterion. As a result, it was decided that this criterion would not be included as part of the chemical scoring.

For each candidate chemical, a relative score was developed based on the primary criteria scores. A scoring system was developed that allows all of the primary criteria to be considered simultaneously. Under this scoring system, it is possible to apply weighting factors to highlight the significance of one primary criterion over another. However, under this analysis, each primary criterion is considered to be of equal value (25 points) and weight. Total scores for each chemical were calculated by summing the compound's primary criteria scores. The maximum achievable score under this system is 100 points. Each primary criteria score was developed based on one or more equally weighted subcriteria scores. Scores for each of the subcriteria are derived based on information obtained from a variety of data sources including the WMPT. The basis for ranking each subcriterion is a discrete quantitative scale of 0, 1, 2, 3, 4 or 0, 1, 2, 3. Table 1 identifies the data sources associated with each subcriterion and the specific scale applied in developing the subcriterion score. Analysis of the distribution of data obtained from each data source was conducted to determine the fencelines that would be assigned to each discrete score. Selection of scoring fencelines was made based judgement, considering factors such as natural breaks in the distributions or division of the distribution into comparably sized groupings. Appendix A identifies the scoring fencelines that were selected and applied. To account for the fact that not all primary criteria are associated with the same number of subcriteria and not all subcriterion are associated with the same discrete scale (i.e., both 0 to 3 and 0 to 4 scales were applied), the following equation was used to calculate an overall score for each primary criterion.

$$\textit{Weighted Primary Criterion Score} = 25\ \textit{points} \cdot \sum \frac{SC_i}{MaxSC_i} \cdot \frac{1}{n} \qquad \text{Eqn 1}$$

where

SC_i = Score for Subcriterion i (i = 1 to n)

MaxSC = Maximum Score for Subcriterion *i*
1/*n* = Weighting factor for each subcriterion (equal to 1/number of subcriterion associated with the primary criterion)

The total primary criterion scores were summed to obtain a total overall score for each chemical. These relative scores were then used in ranking the chemicals. An example calculation that illustrates this scoring approach is provided in Appendix B. In some cases candidate chemicals are grouped because the compounds are very closely related, have similar toxic effects, or appear together.

The candidate chemical list included 2 chemical categories containing multiple individual chemicals: polychlorinated biphenyls and polycyclic aromatic compounds. In general, scoring of these categories were performed on the basis of the maximum score for any chemical in the category for each subcriterion.

4.0 Primary Criteria

As part of this ranking methodology, a chemical is evaluated based on four primary criteria, PBT Characteristics, Environmental Presence, Quantity / Prevalence, and RCRA Programmatic Concerns. Each of these criteria is discussed below. Each discussion addresses the subcriteria associated with the criterion of concern, data sources used in evaluating the subcriteria, and scoring of the subcriteria. In addition, those subcriterion and data sources that were considered but not include as part of the chemical scoring are identified and discussed.

PBT Characteristics. The *WMNP* goals are based on reducing the most PBT chemicals. This criterion provides a means for identifying such compounds. As discussed above, the September 1998 revised WMPT data were a primary data source considered in the development of this methodology. WMPT contains sufficient data for developing PBT scores for nearly 2900 chemicals. The WMPT data includes PBT subscores for both human and ecological receptors, and individual P, B, or T scores for both receptors. Because of these options, there are a variety of scoring combinations that were considered for use in defining this criterion. Preliminary analyses were conducted to determine which scoring combinations would convey the greatest amount of information about a chemical without being repetitive. Also, efforts were made to ensure that the potential for inadvertently eliminating priority compounds from consideration due to data gaps (i.e, incomplete P, B or T scores) was minimized. Based on these analyses, it was decided that there were three potential PBT scoring options that could serve as subcriteria for evaluating PBT characteristics. These criteria included 1) Highest PBT subscore for ecological or human health; 2) total PBT score; and 3) Highest PT score for ecological or human health. However, further evaluation of these subcriteria indicated that scoring of this criterion should be based upon only one of these subcriteria, the highest PBT subscore for ecological or human health. Three subcriteria originally consider for scoring are discussed below. Each discussion addresses why the criterion was included or excluded from consideration in scoring this criterion.

Highest PBT subscore for ecological or human health. As discussed above, this is the only subcriterion that was considered in scoring the *PBT Characteristic* criterion.

Ranking chemicals based on their human health (HH) or ecological PBT scores (i.e., P + B + Human T or P + B + Eco T) allow chemicals that rank highly on one or the other — but not both — to still be considered for the RCRA PBT List. One advantage to this is that chemicals for which scoring is complete either for human health or ecological PBT were evaluated. In scoring this subcriterion, both the ecological and the human health subscores were looked at and then the higher of the two was evaluated. Human health and ecological concern subscores range from 3 to 9 points in the WMPT. The majority of the chemicals included on the candidate chemical list are associated with WMPT subscores of 7 or higher (a maximum score has a value of 9). Therefore, the following scoring system was applied to this subcriterion:

Higher WMPT subscore < 7 = score of 0.
Higher WMPT subscore of 7 = score of 1.
Higher WMPT subscore of 8 = score of 2.
Higher WMPT subscore of 9 = score of 3.

For example, if a chemical had a human health PBT score of 8 (the maximum PBT subscore possible is a 9) and ecological PBT score of 6, the human health subscore would serve as the basis for scoring of this subcriterion. Therefore, this compound would receive a score of 2 under this subcriterion.

There are a few chemicals that were included on the candidate list because they were included from a draft list developed as part of another EPA initiative to identify PBT chemicals of concern. In the event that complete data to score these chemicals were not in the WMPT data, this criterion was not considered for ranking these compounds. As an alternative, the compound's overall score was developed based on the remaining 3 primary criteria (i.e., *Environmental Presence, Quantity / Prevalence,* and *RCRA Programmatic Concern*) with the criteria weighting factors adjust appropriately.

Total PBT scores. Initially, evaluation of total PBT scores was considered as a subcriterion for scoring purposes. Theoretically, ranking chemicals based on total PBT score would allow those chemicals with both high human health and ecological PBT subscores to be addressed. However, investigation of the underlying data indicated that data were not always available for all of the compounds. As a consequence, certain chemicals of concern for which complete data are not available would have been screened out. Therefore, it was decided that total PBT scores would not be considered in developing the *PBT Characteristics* primary criterion score.

Highest PT score for ecological or human health. Initially, the highest PT score for a given chemical was considered for scoring. Under this subcriterion, chemicals that are persistent and toxic, but not bioaccumulative would have been considered. Some compounds, such as certain types of metals, are a potential hazard because they are toxic and highly persistent, yet they do not bioaccumulate appreciably. Basing this criterion on the persistence and toxicity scores of chemicals would have accounted for this. However, it was determined that this approach would not be consistent with the WMNP goals. Specifically, the goal of the WMNP is to focus on those chemicals that pose potential threats to human health and the environment because they are persistent, bioaccumulative,

and toxic (PBT). By focusing on two of these characteristics rather than all three (i.e., P, B, T) would imply that a chemical's tendency to bioaccumulate should receive less weight than it's persistent or toxic nature. Therefore, this subcriterion was not included as part of the ranking methodology.

In addition to the PBT scoring options discussed above, Severity of Toxic Effects was also discussed as a possible subcriterion. Originally, this issue was considered in order to evaluate the basis for the WMPT toxicity score. Under the WMPT toxicity scoring system, it is possible for a chemical that causes slight biochemical changes at low doses to have a lower RfD (i.e., more toxic) than a chemical that damages major organ systems at low doses. In some cases, a low RfD may simply reflect a high level of uncertainty in the scoring system rather than indicating high toxicity. Because it was determined that this effort would be rather resource intensive and would in most cases be subject to scoring based on judgement, this area was not be pursued.

Environmental Presence. The purpose of this primary criterion is to supplement the PBT scores by highlighting those chemicals that are most frequently detected in the environment and those detected at levels that pose a potential risk to human health and the environment. If a chemical is identified as being present in the environment at a level of concern, then efforts should be made to reduce or eliminate future releases. This criterion is associated with three subcriteria. Scoring of this subcriterion is accomplished based on three national environmental databases.

EPA's Fish Advisory Database - The EPA's National Listing of Fish Consumption Advisories database (USEPA 1998b) identifies chemical compounds for which fish advisories have been posted throughout the country. The database was downloaded from www.epa.gov/OST/fishadvice/. Numbers of sites were generated for each chemical by running the program "Nlfca97.exe." After clearing the initial screen, "by parameter" was chosen from the "search" menu. After selecting all 10 EPA regions and selecting the chemical of interest (by name), pressing "View Data" provides the site count. Scoring of this database was based on the number of site advisories associated with each chemical. A discrete scale 0 to 3 was applied with a 0 being assigned if no advisory is reported and a 3 being assigned to those chemicals associated with the highest number of advisories. The fencelines selected and assigned to each discrete score are identified in Appendix A.

EPA's National Sediment Inventory (NSI) - The NSI compiles survey data regarding sediment quality nationwide. These data were obtained from number of data sources including the EPA's STOrage and RETrival system (STORET) and Ocean Data Evaluation System (ODES). Using the NSI data, the EPA conducted a screening analysis to assess the probability of associated adverse human or ecological effects. A total of 21,096 sampling stations were evaluated and classified as each as follows:
Tier 1 : Associated adverse effects are probable;
Tier 2: Associated adverse effects are possible, but expected infrequently
Tier 3: No indication of associated adverse effects.
Through the use of these classifications, scoring of this data source was accomplished. Scores were developed based on the combined number of Tier 1 and Tier 2 advisories associated with each chemical (USEPA 1997a, 1997b). These data are presented in Appendix D of The Incidence and Severity of Sediment Contamination in Surface Waters of the Unites States Volume 1: National Sediment Quality Survey. A 0 to 3 discrete scale

was applied in scoring this data source. Appendix A identifies the fencelines that were assigned to each discrete score.

Agency for Toxic Substances and Disease Registry (ATSDR) HazDat - This database compiles multimedia sampling data collected by ATSDR for both historical (i.e., those sites that have been remediated) and current Superfund sites (ATSDR 1998). Scoring of this data source considered the number of current Superfund sites associated with a given chemical. In order to obtain these counts, the HazDat database was searched for each candidate chemical. These data were downloaded for each chemical and screened in 2 ways using MS Access:

1) to include only those sites that are current identified as National Priorities List (NPL) sites, the Site ID numbers for each reported incidence in the HazDat database for the chemical were compared with a listing of the current NPL sites downloaded on September 27, 1998 as a comma-delimited ASCII file from http://www.epa.gov/superfund/oerr/siteinfo/index.htm#nplsites, and

2) the remaining occurrences were screened to eliminate duplicate detections of a chemical at a given site (e.g. if a chemical was detected 5 times at the same site, this only counted as 1 site, not 5). Analysis of the current sites resulted in a distribution of the number of associated with each candidate chemical. A 0 to 3 discrete scale was applied in scoring this data source. Appendix A identifies the fencelines associated with each discrete score.

Efforts were made to identify or include a number of other data sets of databases that would provide a more accurate picture of contaminant levels in the environment and provide some indication of which chemicals pose an increased threat to human health and the environment. The databases or data sets that were considered for evaluation of this subcriterion but were excluded are identified below. For the most part, these data were excluded either because the data were not nationally representative, readily available, or the data were addressed by a more comprehensive data set already included under this criterion.

Superfund Record of Decision (RODs) database - Similar to the ATSDR HazDat, this database provides extensive information on each cleanup site including the identification of chemicals of concern (USEPA 1998c). However, conducting chemical-specific data searches with the RODs database was not possible. Due to this limitation, the ATSDR HazDat database was selected over the RODs database for use in evaluating this criterion.

Ambient Air Data - Only a limited amount of ambient air data are currently available for toxic pollutants. The U.S. EPA *1996 National Air Quality and Emissions Trends Report* states that presently there is no national ambient air quality monitoring network designed to perform routine measurement of air toxic levels (USEPA 1997c). Furthermore, this report points out that ambient data for individual air toxic pollutants is limited both spatially and temporally in comparison to data available for the six criteria pollutants. The Agency is collecting ambient air data under several efforts (e.g., the PAMS Program collects concentration data for ozone and its precursors which includes 10 hazardous air pollutants (HAPs)). However, these efforts typically focus on only a limited number of

hazardous air pollutants found in select areas of concern (e.g., major metropolitan areas). Based on these limited data, it would be difficult to develop a full understanding of the distribution of pollutants and pollutants concentrations. Consequently, this subcriterion was not evaluated as part of the ranking methodology.

As an alternative to evaluating environmental presence based on ambient air data, consideration was given to the list of 40 potential HAPs identified by the Urban Area Toxics Program (www.epa.gov/ttnuatw1/112k/112kfac.html). These compounds were identified as a starting point for determining the 30 HAPs that present the greatest threat to public health. Identification of these compounds was made based on available toxicity, ambient monitoring, and emissions data, and results from existing exposure and risk assessment studies. Since the focus of this list was not on PBT chemicals and was limited to urban areas, it was decided that scoring of compounds based on this list would not necessarily be consistent with the WMNP goals.

STORET - STORET is EPA's national STOrage and RETrival system for managing and analyzing ambient water quality data (USEPA 1998d). Even though STORET maintains pollutant level data for water column, bottom sediment, and tissue, it was decided that the National Sediment Inventory and the EPA's Fish Advisory Database would serve as more comprehensive and meaningful data sources than STORET (i.e., pollutants that are present in the environment at levels of concern are easily identified). Also, the NSI draws from a number of data storage systems including STORET and therefore including STORET would possibly result in double counting.

Drinking Water Occurrence Database and Pesticides in Ground Water Database - Efforts were made to identify data sources that would be useful in identifying which PBT chemicals pose the greatest threat to human health via drinking ingestion (e.g., those chemicals most frequently detected and detected at levels of concern). Two potential database were identified, the Drinking Water Occurrence Database and Pesticides in Ground Water Database (USEPA 1998e). Unfortunately the Drinking Water Occurrence Database is currently under development and will not be available until 1999 and the Pesticides in Ground Water Database could not be obtained in sufficient time for evaluation. Furthermore, this database was limited to pesticides and did not address other potential PBT chemicals.

RCRA Corrective Action and other RCRA environmental databases (e.g., Ground water monitoring data) - Because the *WMNP* goals are based on reducing the most PBT chemicals in hazardous waste, efforts were made to obtain readily available data that would provide an indication of which RCRA hazardous waste constituents pose a risk in the environment due to the management and mismanagement of RCRA wastes. However, usable data could not be identified. Furthermore, EPA Corrective Action program staff indicated that data concerning contaminant presence at superfund sites should represent a reasonable surrogate for contaminant presence at RCRA Corrective Action sites for purposes of this analysis.

Quantity / Prevalence. This criterion is intended to serve as an indicator of a chemical's environmental release and exposure potential in terms of quantity and industrial prevalence. The

data sources that were used in the evaluation of this primary criterion included the Toxic Release Inventory (TRI), National Hazardous Waste Constituent Survey (NHWCS), and the Biennial Reporting System (BRS). Each of these data sources is described below. Appendix D presents the data that were extracted from each of these data sources and applied in conducting this analysis.

- TRI - The EPA's TRI compiles annual reports of toxic chemical releases to the environment. EPA requires these reports to be submitted under the authority of Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA). These reports are submitted on EPA Form R, the Toxic Release Inventory (TRI) Reporting Form. Facilities must report the quantities of both routine and accidental releases of listed toxic chemicals, as well as the maximum amount of the listed toxic chemical on-site during the calendar year and the amount in wastes transferred off-site. TRI Reporting Form A is available as an alternate threshold reporting option. Reporting Form A can be submitted for a facility which manufactures, processes, or otherwise uses 1 million pounds or less of a chemical annually, and if 500 pounds or less of that chemical is present in their annual reportable amount. The 1995 TRI data used for this analysis was obtained by RTI in 1997 (USEPA 1997d).

- NHWCS - The NHWCS was a one-time survey of waste management facilities conducted in 1996 by EPA to develop a better understanding of the constituents found in hazardous waste. The NHWCS provides constituent concentration data for RCRA hazardous waste streams. The survey sample set was designed to cover facilities managing over 90 percent of the following wastes: total waste, listed waste, characteristic wastes, mixed listed and characteristic waste, non-waste waters, and combusted wastes. The survey was sent to 221 treatment, storage, and disposal facilities (TSDFs) (including pretest facilities) and survey responses included 727 waste constituents. NHWCS data files, which included quantity data, were provided to RTI by the EPA on June 3, 1998 (USEPA 1998f).

- BRS - The BRS is a national system that collects data on the generation, management, and minimization of hazardous waste. BRS compiles data submitted by large quantity generators (LQGs) of hazardous waste and data on waste management practices from treatment, storage, and disposal facilities. RTI used 1995 BRS data obtained in October of 1997 (USEPA 1997e).

Two equally weighted subcriteria, Quantity and Prevalence, were evaluated in scoring this primary criterion.

Quantity - Considering the quantity of a chemical in hazardous waste may provide a better indicator of the potential "risk" associated with a chemical than does the PBT score alone. Specifically, it is assumed that exposure potential is related to quantity generated. Therefore, if a chemical is associated with a relatively large quantity, then it is assumed that a greater potential exists for exposure. Scoring of this subcriterion was based on two equally weighted factors: 1) the total chemical quantity generated annually in RCRA waste (based on the Toxic Release Inventory or the National Hazardous Waste Constituent

Survey data); and 2) the quantity of hazardous waste associated with the chemical based on data in the Biennial Reporting System (BRS). Both factors were considered because the first provides a better reflection of chemical quantities generated while the second provides a better indicator of the waste quantities covered by the RCRA program. Further, BRS covers more SIC codes and more RCRA generators than does the TRI.

1) Estimated Chemical Quantity in Waste - For each chemical, efforts were made to estimate the total amount of the chemical that is present in RCRA-relevant wastes generated in a given year. The primary data source that was used in developing this estimate was the Toxic Release Inventory (TRI) database. Even though TRI reporting is not specific to RCRA waste, data reported for various data elements were used to develop estimates for the quantity of chemical present in a RCRA-relevant waste stream. Appendix E provides a discussion of the data processing approach that was applied to identify RCRA-relevant wastes and the TRI data elements that were considered in developing quantity estimates for a given compound. If TRI data were not available for a given PBT chemical, a secondary data source, the National Hazardous Waste Constituent Survey (NHWCS), was used in developing estimates. Two separate sets of scoring fencelines were developed, one for TRI constituents and one for NHWCS constituents. A 0 to 3 scale was implemented as part of each scoring system. Waste quantity fencelines assigned to each discrete score are presented in Appendix A.

2) Waste Quantity Associated with Chemical - Through the use of the Biennial Reporting System (BRS) database and the chemical- RCRA waste code crosswalk (USEPA 1997m), the quantity of RCRA waste associated with each chemical was determined. Appendix F provides a discussion of the data processing approach that was applied in developing quantity estimates from the BRS data. A 0 to 3 scale was applied based on the distribution of the waste quantity data obtained from the BRS. For those candidate chemicals which are not included in the RCRA crosswalk, scoring for this factor was not possible. For these chemicals, the subcriterion score was developed based solely on the Estimated Chemical Quantity in Waste factor, with weights adjusted accordingly.

Prevalence - Similar to quantity, prevalence of a chemical in hazardous waste provides additional information about the potential "risk" associated with a chemical. For example, if a chemical is generated or managed by a large number of facilities, then there is a greater potential for this compound to be released into the environment. To evaluate the significance of a compound to industry, the number of generators of RCRA waste (or number of treatment, storage, and disposal facilities managing a waste for the NHWCS) thought to contain the chemical was estimated. This subcriterion was scored based on two equally weighted factors.

1) Number of Generators or Treatment, Storage, and Disposal Facilities (TSDFs) based on TRI or NHWCS, respectively - For those chemicals listed in TRI, the score for this factor was developed based on the number of facilities filling Reporting Forms R or A for each chemical. For chemicals not listed in TRI, the number of TSDFs managing waste associated with a given chemical were obtained from the NHWCS. Two separate scoring systems were developed, one for TRI constituents and one for

NHWCS constituents. A 0 to 3 scale was implemented as part of each scoring system. The fencelines that were selected for assignment to each discrete score are presented in Appendix A.

2) Number of Generators based on BRS. The Biennial Reporting System database and the chemical- RCRA waste code crosswalk were used in conjunction to identify RCRA waste streams that could potentially contain a given chemical compound. The number of generators associated with these waste streams was then determined. A 0 to 3 scale was applied based on the distribution of the number of generators obtained from the BRS. For those candidate chemicals which are not included in the RCRA crosswalk, scoring of this factor was not possible. For these chemicals, the subcriterion score was developed based solely on the TRI/NHWCS Number of Generators/ TSDFs.

RCRA Programmatic Concerns. EPA assigned each candidate chemical a score from 0 to 4 based on an assessment of the relative importance of the chemical, historically, in implementing the RCRA program. The importance or "relevance" of the chemicals was assessed by a chemical's presence on one or more of the various lists in use in implementing RCRA. Priority was given to those chemicals that are currently or in the past have been a priority and regulated under RCRA. Further, priority was given to those chemicals which are regulated based on risk vs. technology standards, are difficult to treat or remediate, and/or are generated frequently and in greater quantities.

Chemicals that have led to technological treatment or remediation challenges were given highest priority, since even after regulatory controls, they pose challenging RCRA related problems. Those chemicals that are known to form a dense nonaqueous phase liquid (DNAPL) (Cohen 1993; USEPA 1993, 1991a), were identified under the Land Disposal Restrictions (LDR) program as "hard to treat" (Eby 1998), or were chemicals being proposed for regulation under the maximum achievable control technology (MACT) combustion rule or regulated under the Boilers and Industrial Furnaces (BIF) Rule (USEPA 1991b, 1996b), were assigned a score of 4. DNAPLs make groundwater cleanups very difficult and chemicals proposed for regulation under combustion rules present concerns for air. Furthermore, some compounds released from combustion units burning hazardous waste may have the potential to pose risk to human health and the environment since they tend to persist in the environment and bioaccumulate in the food chain.

Chemicals that are not on the lists mentioned above, but are on RCRA lists based on risk concerns, including the Toxicity Characteristic (TC) list in 40 CFR 261.24 and the Appendix VII list of chemicals serving as the basis for hazardous waste listings in 40 CFR 261 (USEPA 1997f, 1997g), were assigned a score of 3. The Agency has historically taken regulatory actions in the RCRA program based on risk assessments of and damage case analyses involving these chemicals and have identified wastes containing these chemicals as hazardous. Minimization of wastes containing these chemicals would therefore likely reduce the hazards of wastes eventually entering disposal.

Chemicals that are regulated under RCRA based on technological, rather than risk based standards were assigned a score of 2. If a chemical was not on the lists above but was on the

Universal Treatment Standards (UTS) list in 40 CFR 268.48 (USEPA 1997h), it was assigned a score of 2. The UTS list often overlaps with the TC and Appendix VII lists, but also includes a relatively small number of chemicals which are not used to identify a waste as hazardous, but instead are simply treatment indicator chemicals for certain wastes.

If a chemical was not on lists above, but was on the RCRA P list of acute hazardous waste in 40 CFR 261.33 (USEPA 1997i), the U list of toxic waste in 40 CFR 261.33 (USEPA 1997j), the Appendix VIII hazardous waste constituent list in 40 CFR 261 (USEPA 1997k), or the Appendix IX ground water monitoring list in 40 CFR 264 (USEPA 1997l), the chemical was assigned a score of 1. These chemicals have been involved in RCRA program implementation, but are of lesser concern. For instance, Appendix IX chemicals are used to set permit parameters but if they are not on the lists mentioned above, would be of lesser concern; and although P list chemicals are of concern due to their acute hazards, they are generated infrequently and usually in small quantities.

Finally, a chemical not on any of the lists above received a 0 score. The scoring of subcriteria for RCRA Programmatic Concern is summarized below.

RCRA Programmatic Concern Subcriterion	Score
Presence on a list of chemicals that can form dense non-aqueous phase liquids, a list of chemicals identified as "hard to treat," or a list of chemicals being addressed under the maximum achievable control technology combustion rule or boilers and industrial furnaces rule	4
Presence on the toxicity characteristic list or the Appendix VII list of chemicals serving as the basis for hazardous waste listings	3
Presence on the land disposal restrictions universal treatment standards list	2
Presence on the RCRA P list of acute hazardous waste, the U list of toxic waste, the Appendix VIII hazardous waste constituent list, or the Appendix IX ground water monitoring list	1
Chemical not present on any of the following RCRA lists	0

Subcriteria that were considered but were included as part of this criterion included the following.

Chemicals from the Hazardous Waste Identification Rule (HWIR) and Air Characteristics Study Projects. To determine RCRA program concern we considered using information from two EPA risk analysis studies, one supporting the proposal of an HWIR rule (USEPA 1995), and the other to analyze potential concerns for management of characteristic wastes in certain types of units (USEPA 1996a). However, since both of these studies are still undergoing EPA revisions, we did not pursue this approach.

Current Waste Management Practices. Initially, current waste management practices were considered in evaluating this criterion. The method (or unit) by which a waste is managed may represent an increased burden on the system in terms of permitting activities. For example, permitting of a hazardous waste incinerator requires extensive resources while permitting of waste treatment tanks are less resource intensive. As a result, it was proposed that a chemical receive a higher score if it is typically associated with a unit that requires an increased level of attention. However, it was determined that scoring of this subcriterion would be very subjective. Therefore, this subcriterion was not included.

Number of Facilities that are Significant Non-Compliers (SNCs). The number of SNCs and the quantity of waste managed by SNC's could be used as an indicator of the amount of attention the RCRA program is having to pay to a particular chemical (i.e., additional burden placed on the system) in terms of added inspections/enforcement activities (USEPA 1998g). Because it is unclear whether being identified as a SNC actually results in an increase on the system, it was determined that this criterion should not be included as part of the ranking.

5.0 Results and Discussion

The ranking methodology was applied to the candidate chemical list which is comprised of 156 PBT chemicals and groupings. Table 2 presents the resulting ranked list of chemicals. As seen from this table, each chemical or chemical grouping is associated with a total chemical score. Relative ranking of the chemicals was conducted based on the total scores. The chemical associated with the highest score, lead, received the highest ranking of 1. Chemicals which received the same score also received the same ranking. For example, 1,1,1-Trichloroethane, Anthracene, Chloroform, gamma-hexachlorocyclohexane, Hexachlorobenzene, and Phenol all received a ranking of 18 based on their chemical-specific total scores of 67.4. Total scores for each chemical were developed based on four primary criteria scores calculated for each chemical:

- PBT Characteristics;
- Environmental Presence;
- Quantity and Prevalence; and
- RCRA Programmatic Concerns

Each primary criteria was weighted equally and was associated with a maximum potential score of 25 points. Therefore, the maximum total chemical score possible was 100 points. An example calculation that illustrates this scoring approach is provided in Appendix B.

As seen from Table 2, the resulting total scores ranged from 8.3 for 2-methoxy-5-nitrobenzenamine to 94.4 for lead. Review of the underlying criterion scores reveals that lead received a maximum score of 25 points under 3 criteria: PBT Characteristics; Quantity and Prevalence; and RCRA Programmatic concerns. A score of 1 under PBT Characteristics resulted in a total score of 8.3 for 2-methoxy-5-nitrobenzenamine. Appendix C presents the underlying primary and subcriteria scores for all of the candidate chemicals.

Table 2. Ranked List of Candidate Chemicals

CAS No.	Chemical Name	Score	Rank	Score Based on Data with Lowest Preference Indicator?
7439921	Lead	94.4	1	
7440439	Cadmium	92.4	2	
N590	Polycyclic aromatic compounds	91.7	3	
7439976	Mercury	91.0	4	
1336363	Polychlorinated biphenyls	86.8	5	
7440224	Silver	79.6	6	
117817	Bis(2-ethyhexyl)phthalate	79.2	7	
86737	Fluorene	78.5	8	
7440473	Chromium	77.8	9	
206440	Fluoranthene	76.4	10	
7440382	Arsenic	73.6	11	
117840	Di-n-octyl phthalate	72.9	12	Y
87683	Hexachlorobutadiene	70.8	13	
91203	Naphthalene	70.1	14	
129000	Pyrene	70.1	14	
84742	Dibutyl phthalate	69.4	16	
85018	Phenanthrene	68.1	17	
71556	1,1,1-Trichloroethane	67.4	18	
120127	Anthracene	67.4	18	
67663	Chloroform	67.4	18	
58899	gamma-hexachlorocyclohexane	67.4	18	
118741	Hexachlorobenzene	67.4	18	
108952	Phenol	67.4	18	
120821	1,2,4-Trichlorobenzene	66.7	24	
7440020	Nickel	66.7	24	
87865	Pentachlorophenol	65.3	26	
7440360	Antimony	64.6	27	
1024573	Heptachlor epoxide	64.6	27	
7440666	Zinc	63.2	29	
95501	1,2-Dichlorobenzene	62.5	30	
72435	Methoxychlor	61.8	31	
608935	Pentachlorobenzene	61.8	31	
127184	Tetrachloroethylene	61.8	31	
79016	Trichloroethylene	61.8	31	
95943	1,2,4,5-Tetrachlorobenzene	61.1	35	

(continued)

Table 2. (continued)

CAS No.	Chemical Name	Score	Rank	Score Based on Data with Lowest Preference Indicator?
83329	Acenaphthene	59.0	36	
191242	Benzo(g,h,i)perylene	59.0	36	Y
75092	Methylene chloride	59.0	36	
7440417	Beryllium	58.3	39	
7782492	Selenium	57.6	40	
7440508	Copper	56.9	41	
319846	Hexachlorocyclohexane, alpha-	56.9	41	
319857	Hexachlorocyclohexane, beta-	56.9	41	Y
75343	1,1-Dichloroethane	56.3	44	
106467	1,4-Dichlorobenzene	56.3	44	
85687	Butyl benzyl phthalate	56.3	44	
57125	Cyanide	55.6	47	
98953	Nitrobenzene	54.9	48	
107062	1,2-Dichloroethane	54.2	49	
541731	1,3-Dichlorobenzene	54.2	49	
101553	4-Bromophenyl phenyl ether	53.5	51	
82688	Pentachloronitrobenzene	52.8	52	
91576	2-Methylnaphthalene	52.8	52	
79345	1,1,2,2-Tetrachloroethane	52.1	54	
732263	Phenol, 2,4,6-tris(1,1-dimethylethyl)-	52.1	54	
208968	Acenaphthylene	51.4	56	Y
959988	Endosulfan, alpha-	51.4	56	
33213659	Endosulfan, beta-	51.4	56	
319868	Hexachlorocyclohexane, delta-	51.4	56	
95954	2,4,5-Trichlorophenol	50.7	60	
76448	Heptachlor	50.7	60	
67721	Hexachloroethane	49.3	62	
7440484	Cobalt	49.1	63	
51285	2,4-Dinitrophenol	48.6	64	
7439965	Manganese	48.1	65	
77474	Hexachlorocyclopentadiene	46.5	66	
94757	2,4-D	44.4	67	
74839	Bromomethane	44.4	67	
122394	Diphenylamine	44.4	67	
74908	Hydrocyanic acid	44.4	67	
56382	Parathion	44.4	67	
75445	Phosgene	44.4	67	
132649	Dibenzofuran	43.8	73	
74884	Iodomethane	43.8	73	Y
599644	Phenol, 4-(1-methyl-1-phenylethyl)-	43.8	73	Y
90437	Phenylphenol, o-	43.8	73	
630206	1,1,1,2-Tetrachloroethane	42.4	77	
298022	Phorate	42.4	77	
106934	Ethylene dibromide (EDB)	40.3	79	
1582098	Trifluralin	40.3	79	

(continued)

Table 2. (continued)

CAS No.	Chemical Name	Score	Rank	Score Based on Data with Lowest Preference Indicator?
96764	Phenol, 2,2-bis(1,1-dimethylethyl)-	39.6	81	Y
7429905	Aluminum	38.9	82	
99650	1,3-Dinitrobenzene	38.2	83	
101144	4,4'-Methylenebis(2-chloroaniline)	38.2	83	Y
106489	4-Chlorophenol	38.2	83	
17804352	Benomyl	38.2	83	
1563662	Carbofuran	38.2	83	
7440622	Vanadium	38.0	88	
7005723	4-Chlorophenyl phenyl ether	36.1	89	
1861401	Benefin	36.1	89	
115322	Dicofol	36.1	89	
40487421	Pendimethalin	36.1	89	
119471	2,2'-Methylenebis(4-methyl-6-tert-butylphenol)	35.4	93	
1675543	Diglycidal ether of Bisphenol A	35.4	93	Y
25154523	Phenol, nonyl-	35.4	93	
79061	Acrylamide	34.0	96	
75218	Ethylene oxide	34.0	96	
107186	Allyl alcohol	34.0	96	
298000	Methyl parathion	34.0	96	
25973551	2-(2'-Hydroxy-3',5'-(di-t-amyl)phenyl)benzotriazole	33.3	100	Y
79743	2,5-Di-(1,1-dimethylpropyl)hydroquinone	33.3	100	
298044	Disulfoton	31.9	102	
1031078	Endosulfan sulfate	31.9	102	
100254	1,4-Dinitrobenzene	31.3	104	
1861321	Dacthal	30.6	105	
107028	Acrolein	29.9	106	
1163195	Decabromodiphenyl oxide	29.2	107	Y
333415	Diazinon	29.2	107	
59669260	Thiodicarb	29.2	107	
2303175	Triallate	29.2	107	
115297	Endosulfan	28.5	111	
128370	2,6-Di-tert-butyl-p-cresol	27.8	112	
1912249	Atrazine	27.8	112	
79118	Chloroacetic acid	27.8	112	
78488	DEF	27.8	112	
9003536	Polystyrene	27.8	112	Y
137268	Thiram	27.8	112	
54115	Nicotinea	27.1	118	Y
75070	Acetaldehyde	25.7	119	
116063	Aldicarb	25.7	119	
60515	Dimethoate	25.7	119	
56038892	Benzenamine, N-(1-ethylpropyl)-3,4-dimethyl-	25.0	122	Y
1689992	Bromoxynil octanoate	25.0	122	
5598130	Chlorpyrifos methyl	25.0	122	

(continued)

Table 2. (continued)

CAS No.	Chemical Name	Score	Rank	Score Based on Data with Lowest Preference Indicator?
119904	3,3'-Dimethoxybenzidine	23.6	125	Y
88891	Picric acid	23.6	125	Y
101779	4,4'-Methylenebisbenzenamine	20.8	127	Y
1897456	Chlorthalonil	20.8	127	
13071799	Terbufos	20.8	127	
834128	Ametryn	19.4	130	
111659	Octane	19.4	130	
92842	Phenothiazine	19.4	130	Y
122349	Simazine	19.4	130	
1120214	Undecane	19.4	130	Y
91941	3,3'-Dichlorobenzidine	17.4	135	
528290	1,2-Dinitrobenzene	16.7	136	
99309	2,6-Dichloro-4-nitroaniline	16.7	136	
20325400	3,3'-Dimethyloxybenzidine dihydrochloride	16.7	136	Y
60093	4-(Phenylazo)benzenamine	16.7	136	
101688	4,4'-Methylenediphenyl isocyanate	16.7	136	
101804	4,4'-Oxybisbenzenamine	16.7	136	
96695	4,4'-Thiobis(6-tert-butyl-m-cresol)	16.7	136	
90948	Bis(4-(dimethylamino)phenyl)methanone	16.7	136	Y
2832408	C.I. Disperse yellow 3	16.7	136	Y
2164172	Fluometuron	16.7	136	
330552	Linuron	16.7	136	
5468757	Pigment yellow 14	16.7	136	Y
1929824	Pyridine, 2-chloro-6-(trichloromethyl)-	16.7	136	
961115	Tetrachlorvinphos	16.7	136	
639587	Triphenyltin chloride	16.7	136	
314409	Bromoacil	14.8	151	
97563	2-Methyl-4-((2-methylphenyl)azo)benzenamine	12.5	152	Y
569642	Basic green 4	11.1	153	
42874033	Oxyfluorfen	11.1	153	
56359	Tributyltin oxide	11.1	153	
99592	2-Methoxy-5-nitrobenzenamine	8.3	156	Y

Figure 1 presents a histogram of the overall chemical scores. The scores show somewhat of a break at about 45-50 points. Sixty-one chemicals had scores of 50 or above. Only 10 compounds received a score greater than 75, while 35 chemicals scored 25 or below. Preliminary review of the upper end of the ranked chemical list indicates that the methodology was effective in highlighting those chemicals that are frequently identified as being of greatest concern. For example, mercury and hexachlorobenzene which are identified on a number of EPA, State, and International PBT chemical lists of concern received scores of 91.0 (ranking of 4) and 67.4 (ranking of 18), respectively. Appendix G presents a number of these EPA and International PBT chemical priority lists that were identified under this work assignment.

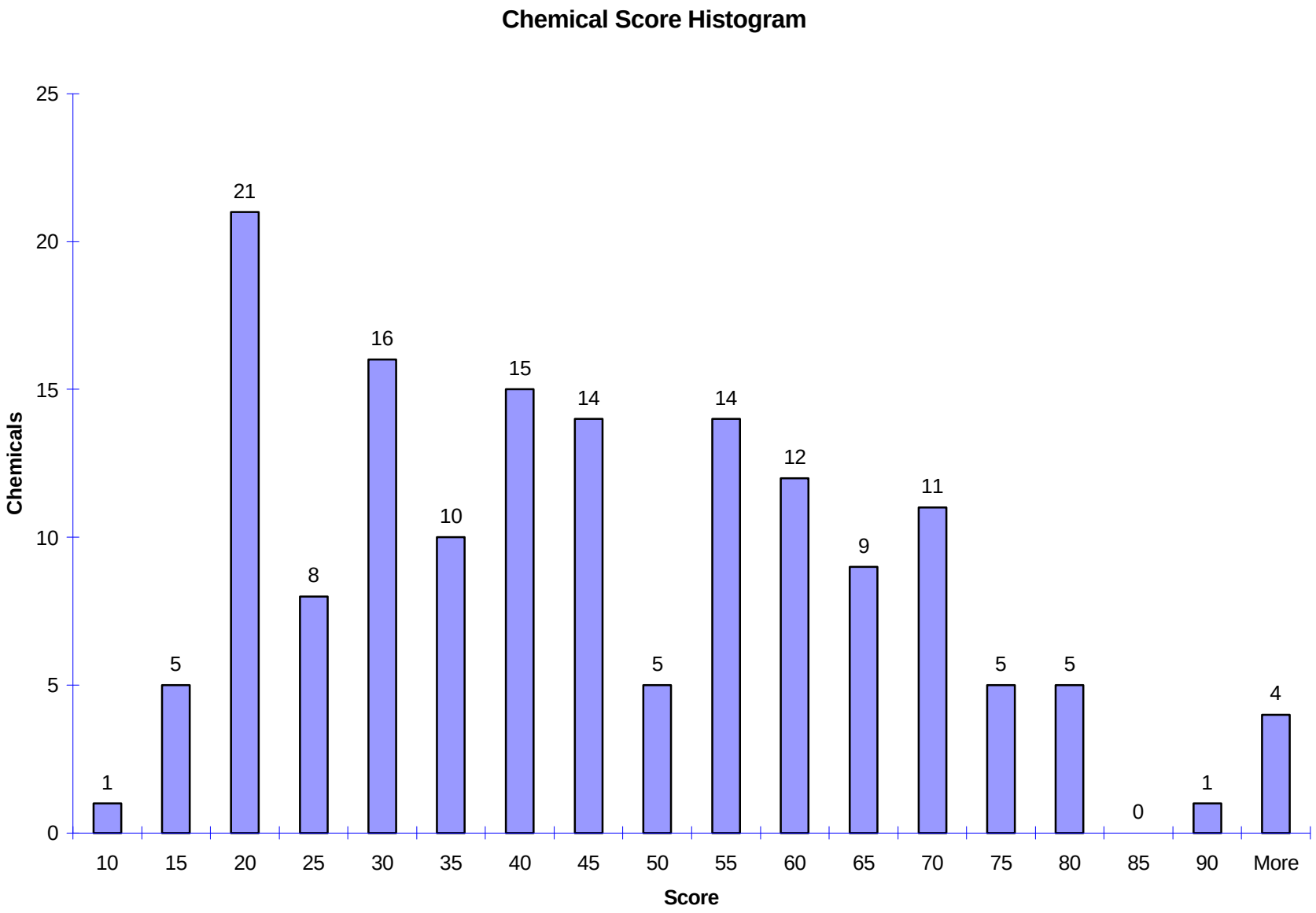

Figure 1. Histogram of total chemical scores.

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